

What is claimed is:

1. A process of manufacturing a membrane electrode assembly, said process comprising the steps of:

preparing an electrode-forming catalyst ink comprising porous carbon aerogel supported catalyst and one or more electrolytes;

depositing the prepared catalyst ink on a polymer film to form one or more catalyst layers;

hot-pressing said one or more catalyst layers deposited on said polymer film at a temperature that is higher than a glass transition temperature of said electrolyte against a membrane;

decreasing the temperature of said hot-pressed catalyst layer and said polymer film; and

removing said polymer film from said one or more catalyst layers.

2. The process of claim 1, wherein said step of preparing said electrode-forming catalyst ink comprises,

grinding said porous carbon aerogel supported catalyst and said electrolyte, and

homogenizing said porous carbon aerogel supported catalyst and said electrolyte in an aqueous solution.

3. The process of claim 1, wherein said catalyst layer comprises at least one noble metal.

4. The process of claim 3, wherein said at least one noble metal comprises a transition metal.

5. The process of claim 1, wherein said step of depositing the prepared catalyst ink on said polymer film is effected by screen printing said prepared catalyst ink, spraying said prepared catalyst ink, micro-gravure deposition, sputtering, spin-coating said prepared catalyst ink, or a combination thereof on said polymer film.

6. The process of claim 1, wherein said step of preparing said electrode-forming catalyst ink comprises mixing said aerogel supported catalyst and said electrolyte with at least one plasticizer.
7. The process of claim 6, wherein said step of preparing said electrode-forming catalyst ink comprises mixing said aerogel supported catalyst and said electrolyte with said at least one plasticizer in an inert atmosphere.
8. The process of claim 7, wherein said step of preparing said electrode-forming catalyst ink further comprises mixing said porous aerogel supported catalyst and said electrolyte in a solvent.
9. The process of claim 7, wherein said step of preparing said electrode-forming catalyst ink further comprises re-homogenizing said porous aerogel supported catalyst and said electrolyte.
10. The process of claim 1, wherein said catalyst layer comprises a single-layer structure.
11. The process of claim 1, wherein said catalyst layer comprises a multiple-layer structure in which adjacently-positioned layers thereof have the same compositions.
12. The process of claim 1, wherein said catalyst layer comprises a multiple-layer structure in which adjacently-positioned layers thereof have different compositions.
13. The process of claim 1, further comprising a step of leaving a residual amount of high boiling point solvent in said catalyst ink before said hot-pressing.
14. A process of preparing a membrane electrode assembly for use in a fuel cell, said process comprising the steps of:
 - preparing a decal having a catalyst ink deposited thereon; and
 - transferring said catalyst ink from said decal to a membrane of said membrane electrode assembly to form an electrode.

15. The process of claim 14, wherein said preparing said decal comprises depositing said catalyst ink on a polymer film.
16. The process of claim 14, wherein said transferring said catalyst ink comprises, placing said decal on said membrane, and hot-pressing said decal against said membrane.
17. The process of claim 16, further comprising removing an inert backing sheet of said decal.
18. A process of preparing an electrode-forming catalyst ink for use in a membrane electrode assembly of a fuel cell, said process comprising the steps of:
 - grinding a porous carbon aerogel having a metal disposed thereon;
 - grinding an electrolyte material; and
 - homogenizing said ground porous carbon aerogel and said ground electrolyte material.
19. The process of claim 18, further comprising applying said electrode-forming catalyst ink to an inert polymer film.
20. The process of claim 19, wherein said applying said electrode-forming catalyst ink comprises screen printing said ink onto said inert polymer film, spraying said ink onto said inert polymer film, depositing said ink onto said inert polymer film using a micro-gravure technique, sputtering said ink onto said inert polymer film, spin-coating said ink onto said inert polymer film, or a combination thereof.